FINAL-ET 42 - Electrician Theory Examination Marking Schedule

Notes: 1. (1 mark) means that the preceding statement/answer earns 1 mark.

2. This schedule sets out the accepted answers to the examination questions. A marker can exercise their discretion and decide on the overall accuracy of any answer that is presented in the candidate’s own words.

3. Symbols and terms - alternatives

Power	W or P
Voltage	V or E or U
Phase	Active

Question 1	*Reference Marks*	*Marking notes*
(a) Any TWO of: ● Voltage applied. ● Current level . ● Contact duration. ● Body resistance ● Current path. ● The frequency of the voltage	(2 marks)	
(b) $V = \sqrt{P \times R}$ $= \sqrt{2204 \times 24}$ $= 230V$	(½ mark) (½ mark) (1 mark)	
(c) Any TWO of: ● The wrong isolating switch has been operated. ● The isolating switch is damaged or faulty ● The neutral is being switched	(2 marks)	
(d) ● Two phases have been reversed on the supply. ● A phase reversal relay is preventing the hoist from starting.	(1 mark) (1 mark)	
(e) An auto transformer can fail in such a way so the primary voltage appears across the secondary	(2 marks)	
(f) “Sensitivity” is the current imbalance required to trip the RCD	(2 marks)	
(g) ● Ensure the meter is operational.	(1 mark)	

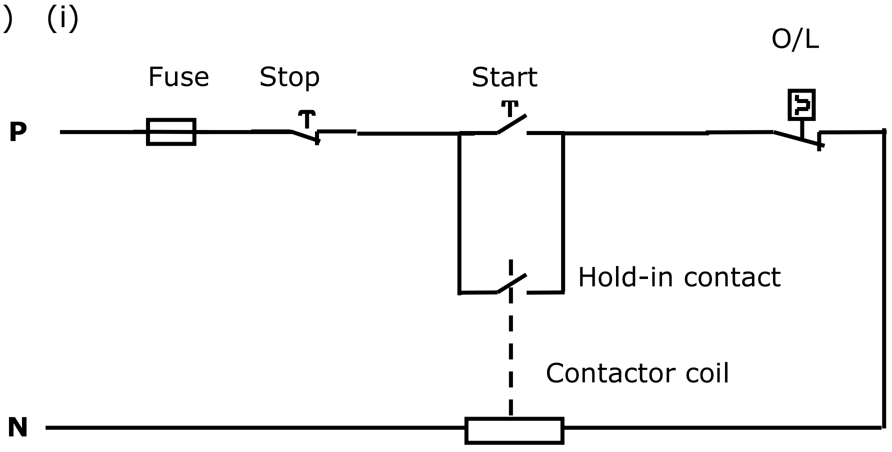
Question 1	*Reference Marks*	*Marking notes*
• By testing on a known live source.	(1 mark)	
(h) (i) Any ONE of: • Solid state current relay • External starting relay • Timer (ii) Any ONE of: • Reverse the connections to the start winding. • Reverse the connections to the run winding. • If windings are identical, move capacitor from start to run winding.	(1 mark) (1 mark)	
(i) • The protective device must be capable of safely clearing that level of prospective short-circuit current without damage. • To ensure the protective device can operate within the minimum permitted time.	(1 mark) (1 mark)	
(j) As current through the protective device increases, the time taken to operate decreases.	(2 marks)	

Question 2	*Reference Marks*	*Marking notes*
(a) (i) $I_{fault} = \frac{V}{R_T}$	(½ mark)	
$= \frac{230}{(5.6 + 0.38)}$	(½ mark)	
$= 38.59A$	(½ mark)	
$I_{total} = I_{fault} + I_{load} = 38.59 + 32$	(½ mark)	
$= 70.59A$	(1 mark)	
(ii) The 40A fuses have a fusing factor (gG Utilisation Category) of 1.5 Fusing current = 1.5 x 40 = 60A	(½ mark)	
The fuse will operate as the fault current of 70.59A is more than the fusing current of 60A	(½ mark)	
(b) (i) $I_{fault} = \frac{V}{R_T}$	(½ mark)	
$I_{fault} = \frac{230}{(5.6 + 4.84)}$	(½ mark)	
$= 22.03A$	(½ mark)	
$I_{total} = I_{fault} + I_{load} = 22.03 + 32$	(½ mark)	
$= 54.03A$	(1 mark)	
(ii) Vd across the fault $Vd_E = I \times R$ $= 22.03 \times 5.06$	(½ mark)	
$= 123.37V$	(½ mark)	
Vd across from frame = 230V – Vd across fault = 230 – 123.37 = 106.63V	(1 mark)	
Shock hazard of 106.63V exists	(1 mark)	

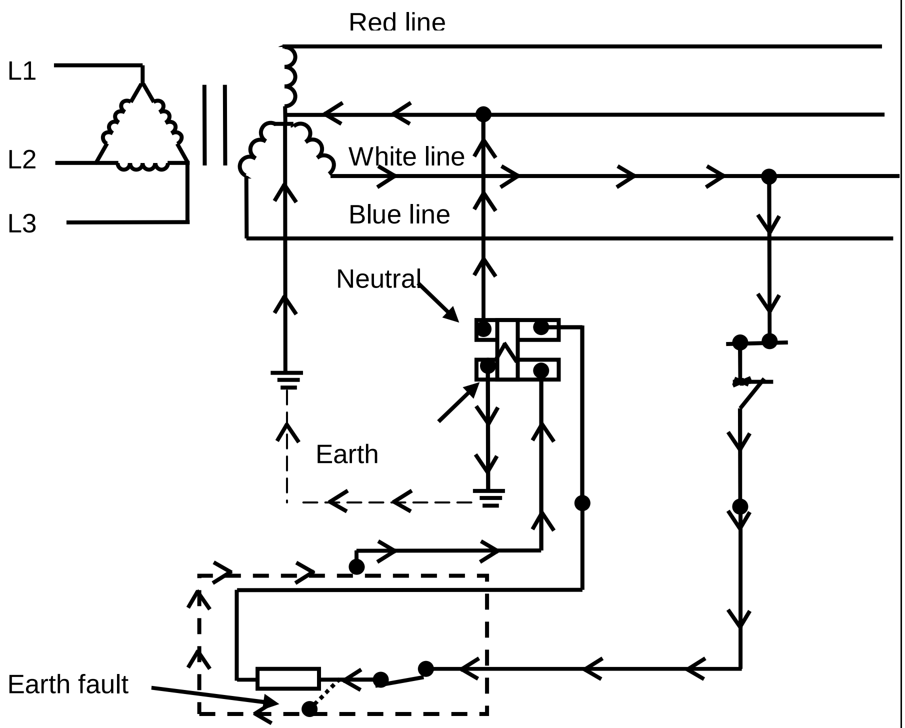
Question 3	*Reference Marks*	*Marking notes*
(a) Parts (i) and (ii) have to include		
- Opening the isolator.	(½ mark)	The isolation can be carried out at the switchboard. The disconnection point can be anywhere downstream of that
- Testing anywhere between the load side of the isolator and the supply side of the contactor.	(1 mark)	
- Using the prove-test-prove method confirm isolation has occurred.	(1 mark)	
- Disconnect the circuit on the load side of the isolator or the contactor.	(1 mark)	
- Attaching a danger tag to the isolator.	(½ mark)	
- After disconnection the cables attached to contactor are protected against damage.	(1 mark)	
- The danger tag is replaced with an out-of-service tag.	(½ mark)	
(b) (i) Ensure the circuit is still isolated by using the prove-test-prove method.	(1 mark)	
(ii) Any ONE of:		
- Insulation resistance test	(½ mark)	
Insulation resistance test function	(½ mark)	
500V d.c. range	(½ mark)	
Test between each element an the frame of the cylinder	(1 mark)	
10, 000 Ω or more	(1 mark)	
- Protective earthing conductor test	(½ mark)	
Resistance function	(½ mark)	
Lowest or auto range	(½ mark)	
Test between the end of the earth on the contactor and the frame of the cylinder	(1 mark)	
1Ω or less	(1 mark)	

Question 4			*Reference Marks*	*Marking notes*
(a)	(i)	The fluorescent tube gives 100 flashes of light per second from the 50 Hz a.c. supply.	(2 marks)	
	(ii)	This can make rotating machinery appear to be stationary **or** revolving very slowly in either direction.	(2 marks)	
	(iii)	Any TWO of: ● Install fittings with ballasts that produce a phase displacement between the tube currents. ● Connect adjacent single tubes on different phases. ● Mix incandescent lighting with the fluorescent lighting.	(2 marks)	
(b)	By fusing each fitting with a 1 amp fuse, compared to the 16A MCB protecting the circuit.		(2 marks)	
(c)	●	The wiring and components in the light fittings have a much lower current rating.	(1 mark)	
	●	The may not be capable of withstanding high currents	(1 mark)	

Question 5	*Reference Marks*	*Marking notes*
(a) (i) Any THREE of: ● Disconnect the MEN link ● Disconnect the main neutral. ● Turn all switches and circuit breakers to the "ON" position. ● Ensure all loads are unplugged	(3 marks)	
(ii) Bridge out phase and neutral and test between the bridge and earth.	(1 mark)	
(b) The description has to show:		
● Disconnection of the water heater and range	(½ mark)	
● Retesting of the electrical installation	(½ mark)	
● A test result for the installation of 1MΩ or greater	(1 mark)	
● Testing of the water heater	(1 mark)	
● A test result for the heater of 10,000Ω or greater	(1 mark)	
● Testing of the range	(1 mark)	
● A test result for the range of 10,000Ω or greater	(1 mark)	

Question 6	*Reference Marks*	*Marking notes*
(a) (i)  O/L Fuse Stop Start P Hold-in contact Contactor coil N		
• Supply correctly connected	(½ mark)	
• Fuse correctly connected	(½ mark)	
• Stop button correctly connected	(½ mark)	
• Start button correctly connected	(½ mark)	
• Hold-in contacts correctly connected	(½ mark)	
• Contactor coil correctly connected	(½ mark)	
• Overload auxiliary contact correctly connected	(½ mark)	
• Correct working circuit	(½ mark)	
(ii) • Connect a fuse in the new phase	(1 mark)	No marks for (ii), if a fuse is not used.
• Any ONE of * Connect another phase to the neutral terminal of the circuit * Change the colour of the neutral conductor to a phase colour	(1 mark)	
(b) • If the windings get too hot (due to excess load) the thermistors embedded in the motor windings change their resistance as the motor windings change temperature.	(1 mark)	
• The change in resistance operates the thermistor monitoring relay which opens the motor control circuit.	(1 mark)	
(c) The maintaining circuit is open-circuited.	(2 marks)	

Question 7		*Reference Marks*	*Marking notes*
(a)	(i) The kiln will operate normally	(1 mark)	
	(ii) Neither the MCB nor RCCB operation is effected.	(1 mark)	
	(iii) The kiln circuitry would be live when the isolating switch is in the "off" position.	(2 marks)	
(b)	The RCCB will trip as the PEC would carry the return current.	(1 mark)	
(c)	(i) The kiln will not operate	(1 mark)	
	(ii) • The MCB will not operate.	(1 mark)	
	• The RCCB may operate	(1 mark)	
	(iii) The kiln framework will be alive at 230V to earth	(2 marks)	

Question 8	*Reference Marks*	*Marking notes*
(a) (i)  Red line L1 L2 L3 White line Blue line Neutral Earth Earth fault		
• MEN system		The path between the star-point and the installation earth need not be shown. The path via the neutral must be shown.
- Star point earthed.	(½ mark)	
- The consumer's main earth connected to the earth bar.	(½ mark)	
- MEN link between earth and neutral bars.	(½ mark)	
- Main neutral connected to consumer's neutral bar.	(½ mark)	
• Final sub-circuit MCBs in phases or actives	(½ mark)	
• Class I appliance correctly connected	(½ mark)	
• Fault is in the correct position.	(½ mark)	
• Correct working diagram	(½ mark)	
(ii) Accurate earth fault loop	(1 mark)	
(b) To ensure that sufficient fault current will flow	(1 mark)	
• To operate the circuit protective device	(1 mark)	
(c) $I_F = \frac{V}{Z}$	(½ mark)	
$= \frac{230}{0.32}$	(½ mark)	

Question 8	*Reference Marks*	*Marking notes*
= 718.75A	(1 mark)	
(d) (i) • The earth bar • The earth electrode	(½ mark)	
(ii) A tag warning against disconnection	(½ mark)	

Question 9	*Marks*	*Reference*	*Marking notes*
(a) (i) $V_{SPhase} = \frac{V_P}{N_P}$	(½ mark)		
$= \frac{66000}{287}$	(½ mark)		
$= 230V$	(1 mark)		
(ii) $V_{SLine} = VPH \times \sqrt{3}$	(½ mark)		
$= 230 \times \sqrt{3}$	(½ mark)		
$= 398.36\ V$	(1 mark)		
(iii) $I_{PLine} = \frac{kVA}{\sqrt{3} \times V_L}$	(½ mark)		
$= \frac{250000}{\sqrt{3} \times 66000}$	(½ mark)		
$= 2.19A$	(1 mark)		
(iv) $I_{SLine} = \frac{kVA}{\sqrt{3} \times V_S}$	(½ mark)		
$= \frac{250000}{\sqrt{3} \times 398.36}$	(½ mark)		
$= 362.34A$	(1 mark)		
(b) A high voltage can be present at the secondary terminals.	(1 mark)		
(c) Any ONE of: ● Laminating the iron core. ● Specially constructed core material (e.g., “stalloy”, “grain-oriented silicon steel”)	(1 mark)		